The Helicopter Monitoring Report

a Report of the New York Bight Water Quality
Summers of 2003 and 2004

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THE HELICOPTER MONITORING REPORT

a Report of the

NEW YORK BIGHT WATER QUALITY

Summers of 2003 and 2004

"The Bight Report"

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Abstract

The Division of Environmental Science and Assessment of the U.S. Environmental Protection Agency, Region 2, has prepared this report to disseminate environmental data collected for the New York Bight. From May 27, 2003 through August 30, 2003; and from May 27, 2004 through September 7, 2004, water quality monitoring and surveillance activities were carried out using a helicopter. The monitoring program is comprised of three separate networks; the beach station network, the perpendicular station network, and the floatable surveillance network.

Results were as follows:

A total of 295 samples in 2003 and 234 samples in 2004 was collected at the Long Island coastal stations, and a total of 301samples in 2003 and 442 samples in 2004 were collected at the New Jersey coastal stations, and analyzed for enterococcus densities. Fecal coliform analyses were conducted in 2003 for the Long Island and New Jersey coastal samples, but only for the Long Island samples in 2004. In 2004, due to new State regulations, fecal coliform analyses were dropped from the New Jersey samples. Low seasonal geometric means were observed at all stations for 2003 and 2004.

The dissolved oxygen semi-monthly averages for the New York Bight and New Jersey coast perpendicular station network, for 2003 and 2004, followed a typical dissolved oxygen sag curve. The lowest semi-monthly dissolved oxygen averages, 6.0 mg/l and 6.2 mg/l, occurred in late August of 2003, and in early and late August of 2004, respectively. Both values are well above the dissolved oxygen guideline considered to be healthy.

Only three beach closure incidents occurred in 2003 due to floatable debris. Eleven New Jersey beaches were closed on July 11, 2003 and two New Jersey beaches were closed on August 19, 2003. All beaches were closed late in the afternoon and reopened the following morning. On July 24 and July 25, 2003, a total of five Long Island coastal beaches were closed due to floatable debris. There were no ocean beach closures along Long Island coastal waters or the New Jersey coastal waters due to floatable debris in 2004.

Based on the data collected, the New York Bight Apex, and the New Jersey and Long Island coastal waters had excellent water quality in 2003 and 2004.

INTRODUCTION

The Division of Environmental Science and Assessment of the U.S. Environmental Protection Agency (EPA), Region 2, has prepared this report to disseminate environmental data for the New York Bight. Specifically, data coverage includes the New York Bight Apex, the New York/New Jersey Harbor Complex, and the coastal shorelines of New York (NY) and New Jersey (NJ).

This report is the twenty-fifth in a series and reflects data collected from May 27, 2003 through August 30, 2003; and from May 27, 2004 through September 7, 2004.

The New York Bight Water Quality Monitoring Program (The Helicopter Monitoring Program) is EPA's response to its mandated responsibilities as defined under the Marine Protection, Research and Sanctuaries Act of 1972, the Water Pollution Control Act Amendments of 1972 and 1977, and the Water Quality Act of 1987. This program was initiated in 1974 and incorporated the use of a helicopter in 1977.

Presently, a modified Twin Star helicopter is used (pictured above).

Pictured to the left is the inside of the helicopter showing the specially modified sampling well, kemmerer sampler, and a typical sample bottle. Safety precautions used include wearing a fire resistant nomex flight suit, seat belt, life vest, and helmet for unhindered communication and hearing protection.

SAMPLING AND SURVEILLANCE

Purpose, Procedures and Locations

Water quality monitoring and surveillance activities were carried out using a helicopter. While the helicopter hovered over the surface, sampling was accomplished by lowering a one liter Kemmerer sampler into the water.

Details of the analytical and sampling procedures can be found in the Quality Assurance Project Plan for the New York Bight Summer Monitoring Program (available upon request). The raw data can be found in EPA's computerized database for STOrage and RETrieval (STORET).

The monitoring program is composed of three separate networks.

The beach station network

is sampled to gather bacteriological water quality information on swimmability for comprehensive public health protection.

Samples are collected once a week at twenty-six Long Island coastal (LIC) stations extending from the western tip of Rockaway Point eastward to Shinnecock Inlet (Figure 1) and at forty-four New Jersey coastal (JC) stations from Sandy Hook to Cape May (Figure 2). All samples are collected just offshore in the surf zone at one meter depth.

Analyses for fecal coliform and enterococcus bacteria densities are conducted at the EPA Region 2 Edison Laboratory.

The perpendicular station network

is sampled to monitor for bottom dissolved oxygen concentrations and temperature. These parameters are used for early detection of anoxic conditions and trend analysis.

Nine New Jersey coast (JC) perpendicular transects extend east one nautical mile to nine nautical miles off the coast between Long Branch and Hereford Inlet, and one New York Bight (NYB) Apex perpendicular transect extends east from the southern end of Sandy Hook (Figure 3).

New Jersey coast perpendicular stations were sampled at 1, 3, 5, 7, and 9 nautical miles offshore. Historical New York Bight Apex stations, NYB 20, 21, 22, 23 and 24, were sampled approximately 2, 4, 6, 7, and 8 nautical miles off the southern end of Sandy Hook.

Samples are collected one meter above the ocean floor, eight to ten times during the critical summer period. The dissolved oxygen analyses are conducted at the EPA Region 2 Edison Laboratory.

The floatable surveillance network

encompasses overflights of the New York/New Jersey Harbor Complex six days a week during the summer months. This surveillance is in response to the Short Term Action Plan for Addressing Floatable Debris, (USEPA 1989) developed by the Interagency Floatable Task Force. The plan was initiated after extensive garbage washups and beach closures occurred in 1987 and 1988. The plan's objectives are to improve water quality, protect the marine environment, and prevent the occurrence of beach closures due to floatables debris. This is accomplished by sighting slicks and determining the most efficient coordinated cleanup effort possible. Approximate size or dimension, contents, relative density, location, possible sources and time of sighting of significant floatable debris are recorded. The information is reported to a central communication response network, specifically established to coordinate cleanup efforts. Cleanup efforts are conducted via skimmer boats or vessels by the Corps of Engineers or the New York City Department of Environmental Protection.

For purposes of this report, the New York/New Jersey Harbor Complex is defined as the following five waterbodies: 1) the Arthur Kill; 2) Newark Bay, as far north as the New Jersey Turnpike Bridge; 3) the Kill Van Kull; 4) the Upper New York Harbor, including the lower portions of the Hudson River and the East River as far north as Central Park, New York; and 5) the Lower New York Harbor including Gravesend Bay, and the shoreline of Coney Island as far east as the Marine Parkway Bridge (Figure 4).

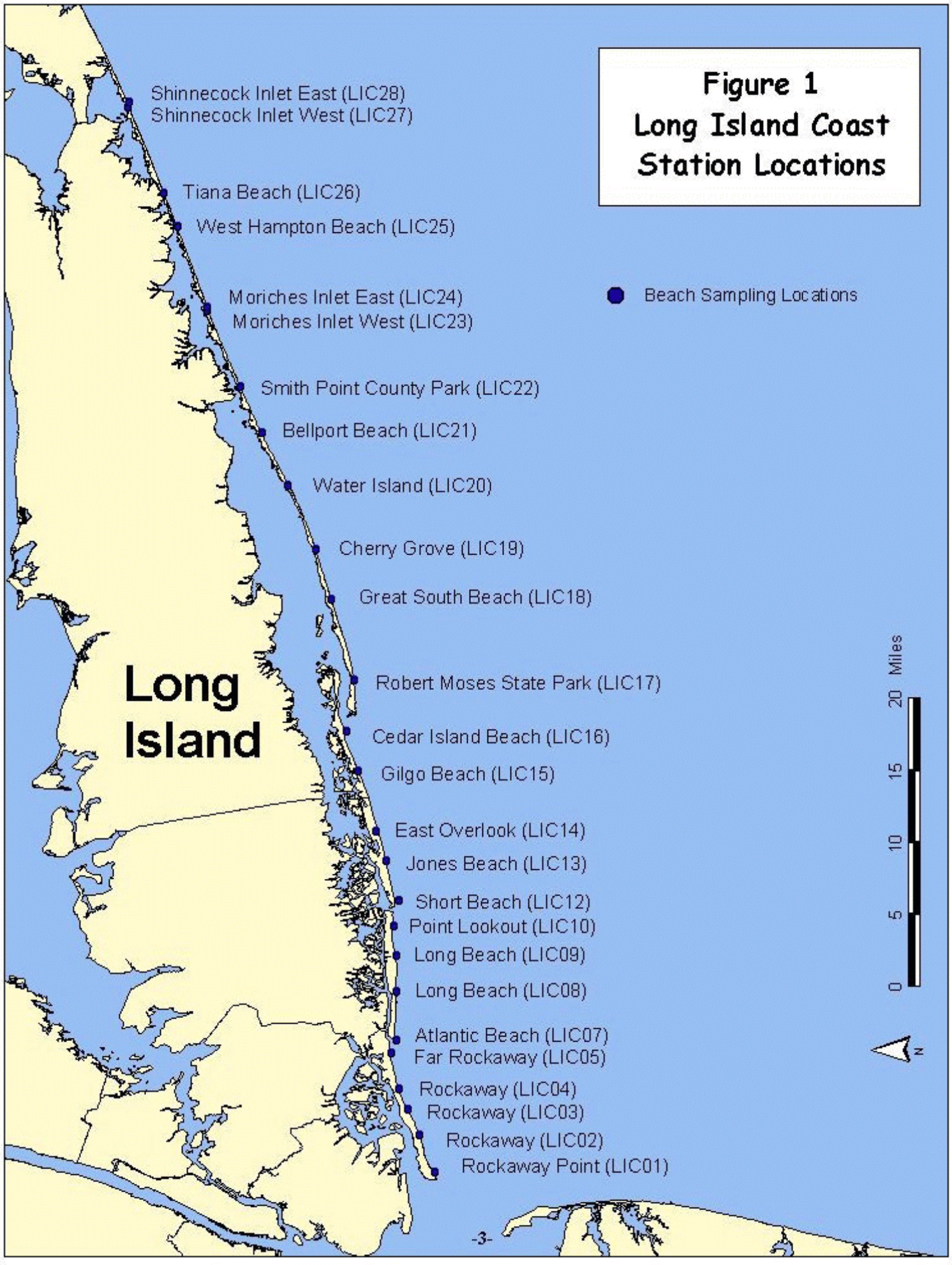


Figure 1
Long Island Coast
Station Locations
Beach Sampling Locations
Shinnecock Inlet East (LIC28)
Shinnecock Inlet West (LIC27)
Tiana Beach (LIC26)
West Hampton Beach (LIC25)
Moriches Inlet East (LIC24)
Moriches Inlet West (LIC23)
Smith Point County Park (LIC22)
Bellport Beach (LIC21)
Water Island (LIC20)
Cherry Grove (LIC19)
Great South Beach (LIC18)
Robert Moses State Park (LIC17)
Cedar Island Beach (LIC16)
Gilgo Beach (LIC15)
East Overlook (LIC14)
Jones Beach (LIC13)
Short Beach (LIC12)
Point Lookout (LIC10)
Long Beach (LIC09)
Long Beach (LIC08)
Atlantic Beach (LIC07)
Far Rockaway (LIC05)
Rockaway (LIC04)
Rockaway (LIC03)
Rockaway (LIC02)
Rockaway Point (LIC01)
Long Island
0 5 10 15 20 Miles
N


Figure 2
New Jersey Coast Station Locations
New Jersey
Sandy Hook (JC01A)
Sandy Hook (JC03)
Sandy Hook (JC05)
Sea Bright (JC08)
Monmouth Beach (JC11)
Long Branch (JC13)
Long Branch (JC14)
Asbury Park (JC21)
Bradley Beach (JC24)
Shark River Inlet (JC26)
Belmar (JC27)
Spring Lake (JC30)
Spring Lake (JC33)
North Manasquan Inlet (JC35)
South Manasquan Inlet (JC37)
Bay Head (JC41)
Mantoloking (JC44)
Silver Beach (JC47A)
Lavallette (JC49)
Seaside Heights (JC53)
Island Beach State Park (JC55)
Island Beach State Park (JC57)
Island Beach State Park (JC59)
Barnegat (JC61)
Harvey Cedars (JC63)
Ship Bottom (JC65)
Beach Haven Terrace (JC67)
Beach Haven Heights (JC69)
Brigantine (JC73)
Absecon Inlet (JC74)
Atlantic City (JC75)
Ventnor City (JC77)
Longport (JC79)
Ocean City (JC81)
Peck Beach (JC83)
Strathmere (JC85)
Sea Isle City (JC87)
Avalon (JC89)
Hereford Inlet (JC92)
Wildwood (JC93)
Two Mile Beach (JC95)
Cape May Inlet (JC96)
Cape May (JC97)
Cape May Point (JC99)
Beach Sampling Locations
0 10 20 Miles
N


Figure 3
New Jersey and New York Bight Apex
Perpendicular Stations
NYB 20's
JC14 - Long Branch
JC27 - Belmar
JC41 - Bay Head
New Jersey
JC53 - Seaside Heights
JC61 - Barnegat
JC69 - Beach Haven
JC75 - Atlantic City
JC85 - Strathmere
JC90 - Hereford Inlet
0 4 8 12 16 20 Miles
N

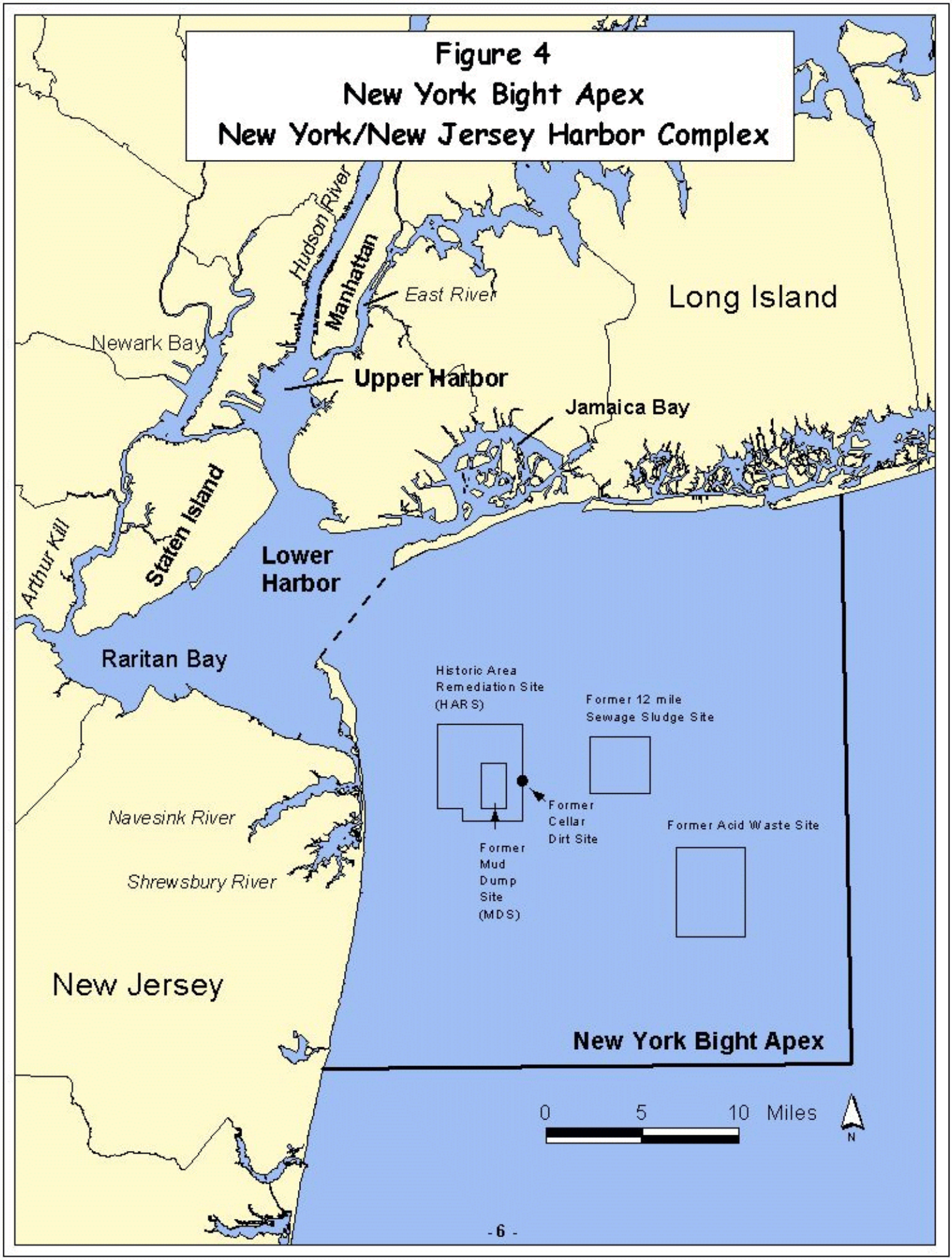


Figure 4
New York Bight Apex
New York/New Jersey Harbor Complex
Hudson River
Manhattan
East River
Long Island
Newark Bay
Upper Harbor
Jamaica Bay
Staten Island
Arthur Kill
Lower Harbor
Raritan Bay
Historic Area Remediation Site (HARS)
Former 12 mile Sewage Sludge Site
Former Cellar Dirt Site
Former Acid Waste Site
Former Mud Dump Site (MDS)
Navesink River
Shrewsbury River
New Jersey
New York Bight Apex
0 5 10 Miles
N

THE BEACH STATION NETWORK

Guideline, Criteria and Standards

By determining the bacteriological water quality, one can estimate potential health risks associated with ocean recreational activities. Epidemiological studies have attempted to assess the incidence of illness associated with bathing in water containing fecal contamination. Evidence exists that there is a relationship between bacterial water quality and transmission of certain infectious diseases (Cabelli, 1979).

It is common practice to use an indicator organism to detect fecal contamination because of the ease of isolating and quantitating certain microorganisms on membrane filters. When many indicator organisms are present, the likelihood of pathogens being found is far greater. EPA has issued guidelines for the following indicator organisms:

EPA Guidelines/Criteria

Fecal Coliform

A fecal coliform bacterial guideline for primary contact recreational waters was recommended by the EPA in 1976, and subsequently adopted by most of the States. The EPA guideline states that fecal coliforms should be used as the indicator to evaluate the suitability for swimming in recreational waters, and recommends that fecal coliforms, as determined by MPN or MF procedure and based on a minimum of not less than five samples taken over not more than a 30-day period, shall not exceed a log mean of 200 fecal coliforms/100 ml, nor shall more than 10% of the total samples during any 30-day period exceed 400 fecal coliforms/100 ml (USEPA, 1976).

Enterococci

In 1986, EPA issued a criteria guidance document recommending enterococci and *Escherichia coli* for inclusion into state water quality standards for the protection of primary contact recreational uses in lieu of fecal coliforms. The EPA (1986) recommended criterion for enterococci for marine water is a single sample maximum of 104 enterococci/100 ml, or a minimum of not less than five samples taken over not more than a 30-day period, shall not exceed a log mean of 35/100 ml (USEPA 1986). The Beaches Environmental Assessment, and Coastal Health Act of 2000, required coastal States to adopt the 1986 criteria by April 2004.

Promulgation

As of December 16, 2004, EPA has promulgated water quality criteria for coastal and Great Lake waters that have been designated for swimming, bathing, surfing, or similar water contact activities, and for which the State or Territory did not have in place EPA-approved bacteria criteria that are as protective of human health as EPA'1986 recommended bacteria criteria. New York State coastal and Great Lakes waters were included in this promulgation.

NJDEP Surface Water Quality Standards

For the summer of 2003, New Jersey State used fecal coliform standards. For the summer of 2004, New Jersey adopted and implemented the enterococci standard of 104 enterococci/100 ml. New Jersey local officials may close a beach on the basis of a single sample. Local discretion is allowed up to the point of two consecutive exceedances of 104 enterococci/100ml, when closure is required by New Jersey State law (NJDHSS, 2004).

NYSDEC Surface Water Quality Standards

For the summer of 2003, New York State, for its primary contact recreational coastal waters, allowed the local permit issuing official to choose one of two standards as follows: 1) a thirty day, five-sample log average of 200 fecal coliforms/100 ml, or 2) a thirty day, five sample log average of 2400 total coliforms/100 ml (NYSDEC, 1999). In addition to these standards, in the summer of 2004, for their coastal recreational waters, New York State implemented the enterococcus criteria consistent with EPA's 1986 criteria.

Any exceedances of these criteria are immediately reported to the proper state and local authorities.

BACTERIOLOGICAL RESULTS

Each of the 26 Long Island coastal stations and the 44 New Jersey coastal stations was sampled four to eleven times per year from late May through August. A total of 295 samples in 2003 and 234 samples in 2004 was collected at the Long Island stations, and a total of 301samples in 2003 and 442 samples in 2004 was collected at the New Jersey stations. All samples were analyzed for enterococcus densities, in 2003 and 2004. Fecal coliform analyses were conducted in 2003 for the Long Island and New Jersey coastal samples, but only for the Long Island samples in 2004. In 2004, due to new regulations, fecal coliform analyses were dropped from the New Jersey samples.

Individual Fecal Coliform Counts

All individual fecal coliform counts for the Long Island and New Jersey coastal stations were below the federal guideline of 200 fecal coliforms per 100 ml, in 2003. In 2004, all individual fecal coliform counts for the Long Island coastal stations were below the federal guideline of 200 fecal coliforms per 100 ml.

Individual Enterococcus Counts

Only one enterococcus count per year exceeded the federal single sample maximum of 104 enterococci per 100 ml at the Long Island coastal stations. The exceedances, 228 and 176 enterococci per 100 ml, occurred at Cedar Island Beach (LIC16) on August 19, 2003 and Water Island (LIC20) on July 6, 2004, respectively.

Three enterococcus counts exceeded the federal single sample maximum of 104 enterococci per 100 ml at the New Jersey coastal stations. The exceedances, 105, 120 and 175 enterococci per 100 ml, occurred at Shark river Inlet (JC30) on May 27, 2003, Long Branch (JC13) on August 27, 2003 and Island Beach State Park (JC59) on July 7, 2004, respectively.

Bacteriological Trends

Seasonal geometric means were calculated for each coastal station for the 2003 and 2004 bacteriological results. All seasonal geometric means were substantially below fecal coliform and enterococcus guidelines.

All individual counts that exceeded bacteriological guidelines for the past ten years, are presented in Table 1. The highest occurrence of enterococcus exceedencies, 12 out of 318 samples (or 3.8 %), occurred at the Long Island stations, in 1998. The highest occurrence of fecal coliform exceedencies, 5 out of 567 samples (or 0.8 %), occurred at the New Jersey stations, in 2000.

Based on these data, the bathing waters of Long Island and New Jersey are of excellent quality.

Table 1: Bacteriological Trends 1995 - 2004

	Long Island			New Jersey		
Year	Number of Samples	Number of Values Exceeding 104 Enterococci/100ml	Number of Values Exceeding 200 Fecal Coliform/100ml	Number of Samples	Number of Values Exceeding 104 Enterococci/100ml	Number of Values Exceeding 200 Fecal Coliform/100ml
1995	269	0	1	480	1	1
1996	202	0	0	480	7	0
1997	304	0	0	452	1	1
1998	318	12	0	547	11	1
1999	320	0	0	583	0	0
2000	378	0	0	567	5	5
2001	337	0	1	464	1	0
2002	337	0	1	372	2	0
2003	295	1	0	301	2	0
2004	234	1	0	442	1	*

* New Jersey samples were not analyzed for fecal coliform.

Dissolved Oxygen Guidelines

Dissolved oxygen levels necessary for survival and/or reproduction vary among biological species. Sufficient data have not been accumulated to assign definitive limits or lower levels of tolerance for each species at various growth stages. As in previous reports, the following guidelines will be used (USEPA 1977):

Dissolved Oxygen Guidelines

$ 5 mg/l - healthy
4 - 5 mg/l - borderline to healthy
3 - 4 mg/l - stressful if prolonged
2 - 3 mg/l - lethal if prolonged
< 2 mg/l - lethal in a relatively short time

These guidelines are consistent with EPA's *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras, Nov. 2000* (USEPA, 2000).

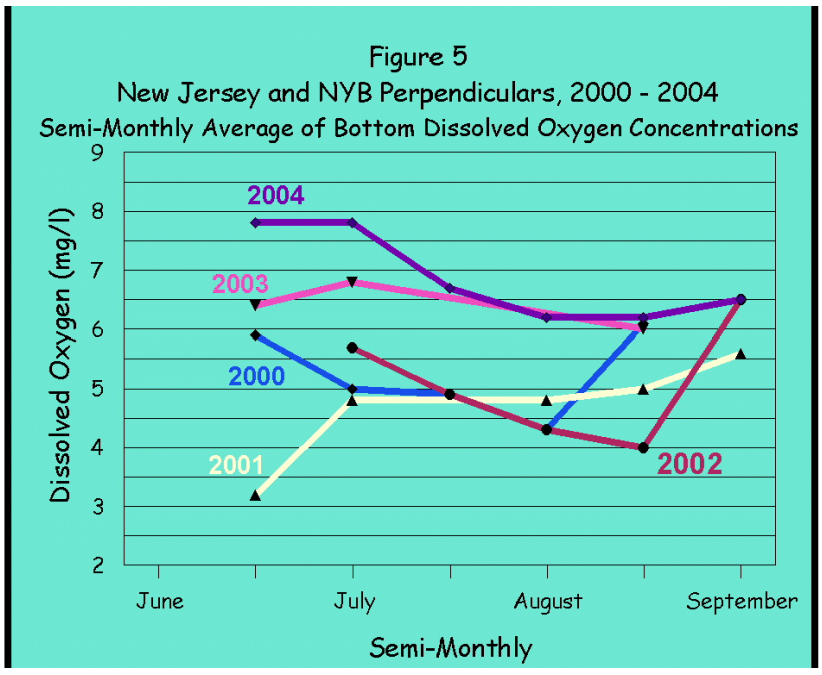
Discussion and Results

A total of 128 bottom water samples in 2003 and 311 bottom water samples in 2004 was collected and analyzed for dissolved oxygen at the New York Bight (NYB20, 21, 22, 23, 24) and New Jersey coast perpendicular stations (JC14, 27, 41, 53, 61, 69, 75, 85, 90). Due to inclement weather, small craft advisories and mechanical difficulties with the helicopter, the 2003 data set is very limited.

For comparison, five years of bottom dissolved oxygen results are presented in Table 2. In all five years, the majority of the dissolved oxygen results was greater than the borderline to healthy guideline of 4 mg/l. There were no individual dissolved oxygen concentrations below 2 mg/l in 2001 or 2003. In 2004, only three dissolved oxygen values, or 1.0%, were less than 2 mg/l. The highest percentage of dissolved oxygen values below 2 mg/l, 5.3%, occurred in 2002.

Table 2: Bottom Dissolved Oxygen Results 2000 - 2004

Year	2000	2001	2002	2003	2004
Total Number of Samples Collected	350	309	301	128	311
% greater than 5 mg/l	54.9	49.2	49.2	88.3	85.9
% between 4-5	20.6	19.1	19.9	9.4	9.6
% between 3-4	15.1	18.1	17.6	2.3	2.9
% between 2-3	9.1	13.6	8.0	0	0.6
% less than 2 mg/l	0.3	0	5.3	0	1.0



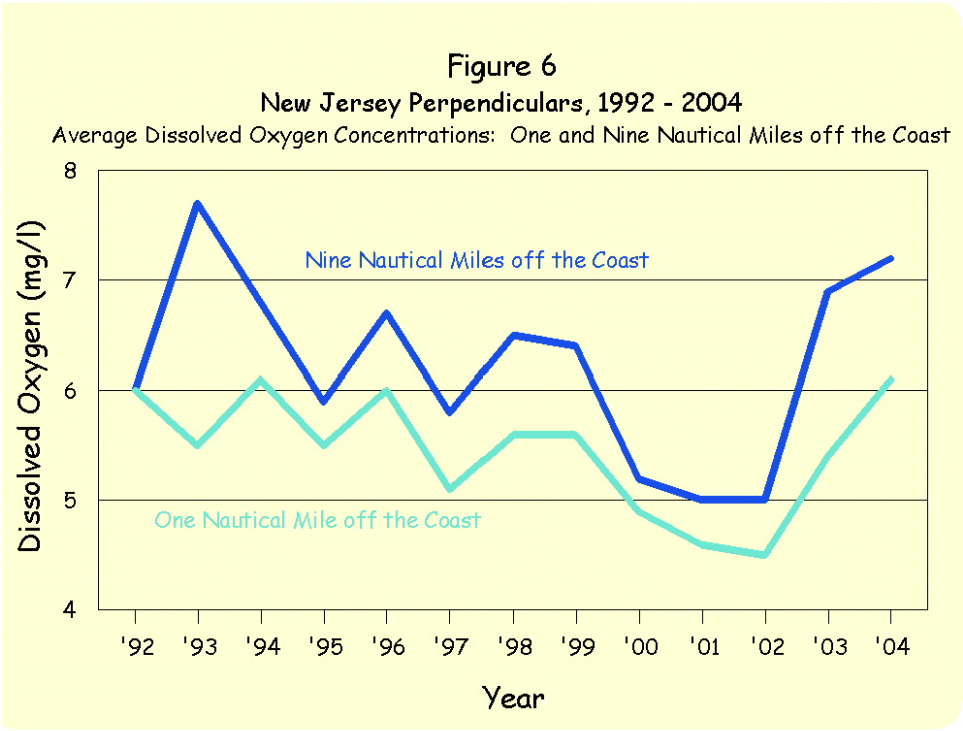
Semi-Monthly Averages

The 2003 and 2004 semi-monthly averages of bottom dissolved oxygen concentrations for the New York Bight and New Jersey coast perpendiculars follow a typical dissolved oxygen sag curve with lows occurring in early to late August (Figure 5). In 2001, a low semi-monthly average dissolved oxygen concentration occurred in late June, with a steady increase through early September. The lowest dissolved oxygen semi-monthly average over the five-year period, 3.2 mg/l, occurred in late June of 2001.

Dissolved Oxygen Trends

One Mile vs. Nine Miles

With the exception of 1992, average dissolved oxygen values are 0.3 to 2.2 mg/l higher nine miles off the coast than one mile off the coast, from 1992 through 2004 (Figure 6). The lower values at the one mile offshore stations can be explained by the oxygen demand created by the influences of river discharges, treatment plant effluents, stormwater runoff, and/or the plume from the Hudson-Raritan River Estuary system.

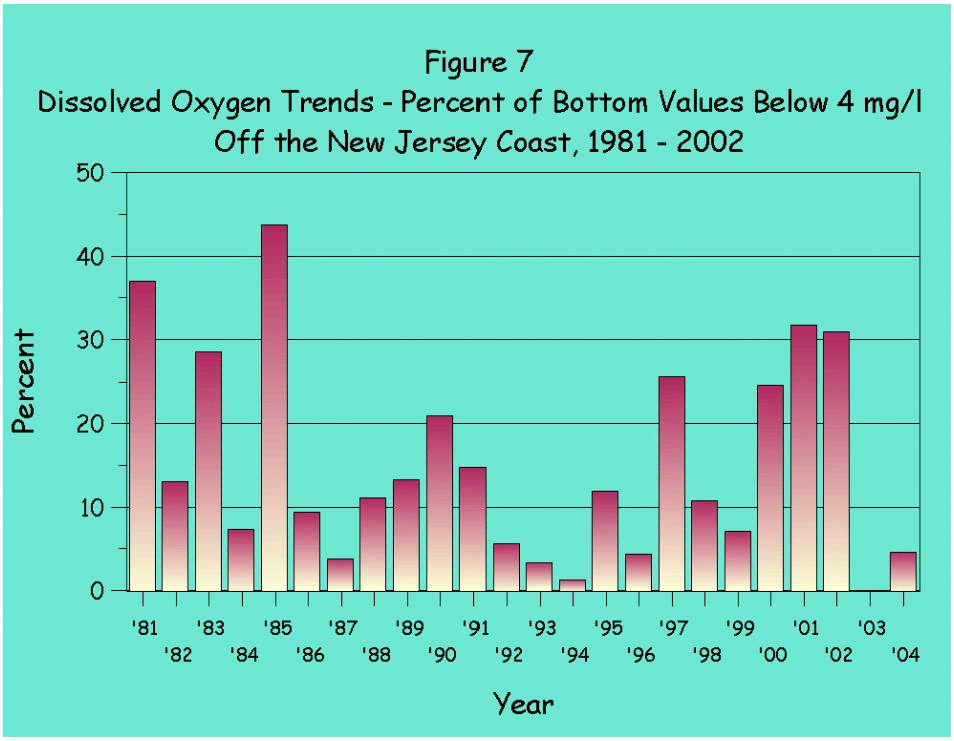


Values Below 4 mg/l

The percent of New Jersey bottom dissolved oxygen values below 4 mg/l, ranged from a low of 1.2 percent to a high of 43.8 percent, during the sampling period of 1981 - 2004 (Figure 7).

Depressed levels fluctuated greatly, year to year, from 1981 through 1986. From 1986 to 1996, fluctuation from year to year was less severe. The highest percentage of hypoxic samples occurred in 1985.

The depressed dissolved oxygen levels in 1985 were attributed to the decomposition of the organisms responsible for the numerous algal blooms that occurred, the lack of meteorological events favoring reaeration, such as substantial winds and storm activity, and the presence of a strong thermocline. The below average dissolved oxygen levels in 1997, 2000, 2001 and 2002 were not as widespread or persistent as those encountered in 1985.



Water Quality

The 2003 data set was very limited, however, during the summers of 2003 and 2004, few coastal algal blooms were observed, strong winds prevailed, water temperature remained low, there were numerous storms promoting reaeration, and no fish kills or adverse effects were reported.

Due to the decreasing dissolved oxygen values observed in 2000, 2001 and 2002, these waters have been listed as impaired and further investigation of low dissolved oxygen off the coast of New Jersey is being conducted by NJDEP.

THE FLOATABLE SURVEILLANCE NETWORK

Observations and Discussion

Floatable surveillance was conducted Monday through Saturday, weather permitting, from May 27, 2003 through August 30, 2003; and from May 27, 2004 through September 7, 2004.

Guidelines for Reportable Floatable Debris

For cleanup purposes, the Short Term Action Plan defined a "slick" as an aggregation of floating debris of indefinite width and a minimum length of approximately 400 meters (USEPA, 1989). Using this as a guideline, all slicks have been divided into three categories (from largest to smallest):

Size Category For Floatable Debris/Slicks

Major: any slick greater than 1600 meters in length
Heavy: 800 meters to 1600 meters
Moderate: 400 meters to 800 meters

All floatable observations have been placed in one of the three categories according to the slick's estimated dimensions, relative density and other recorded observations. The categories of slicks are somewhat subjective. Any slick just short of the length requirement that has a relatively heavy density or extensive width can be moved up a category; as any slick with a relative light density or broken pattern can be moved down a category.

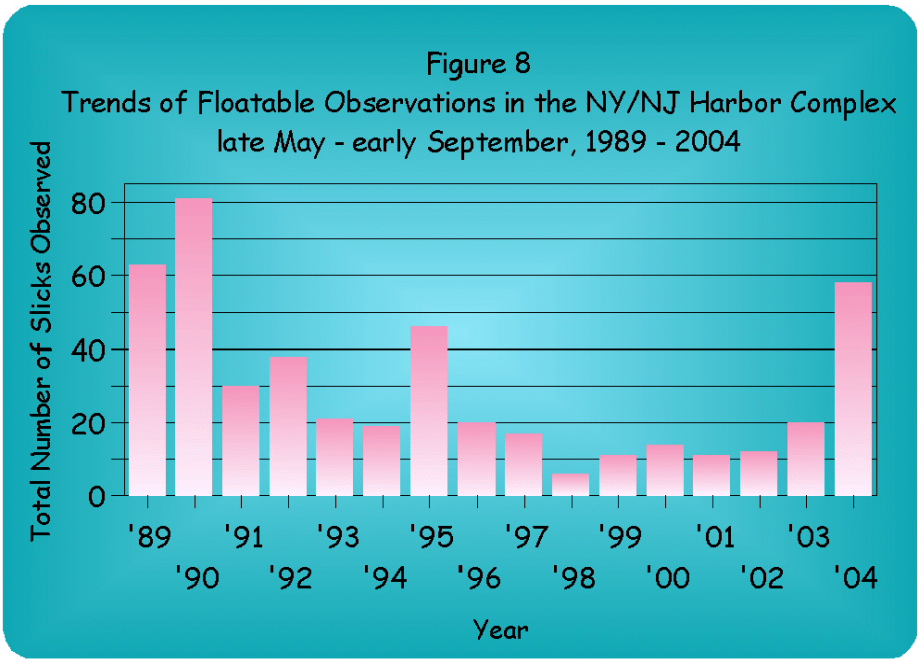
2003 and 2004 Floatable Observations

A total of twenty slicks was observed in 2003. In 2004, fifty-eight slicks were observed (Table 3). During the two year period, the Upper Harbor had the most slicks observed, twenty, in 2004 and the Lower New York Harbor with one slick observed in 2003, had the least.

Table 3

2003				2004		
Moderate	Heavy	Major	Floatable Observations	Moderate	Heavy	Major
8	1	0	Newark Bay	6	3	1
1	0	0	Lower NY Harbor	3	4	5
3	1	0	Upper NY Harbor	8	5	7
2	0	2	Arthur Kill	6	1	0
2	0	0	Kill Van Kull	4	4	1

Figure 8
Trends of Floatable Observations in the NY/NJ Harbor Complex
late May - early September, 1989 - 2004



Floatable Observation Compilation

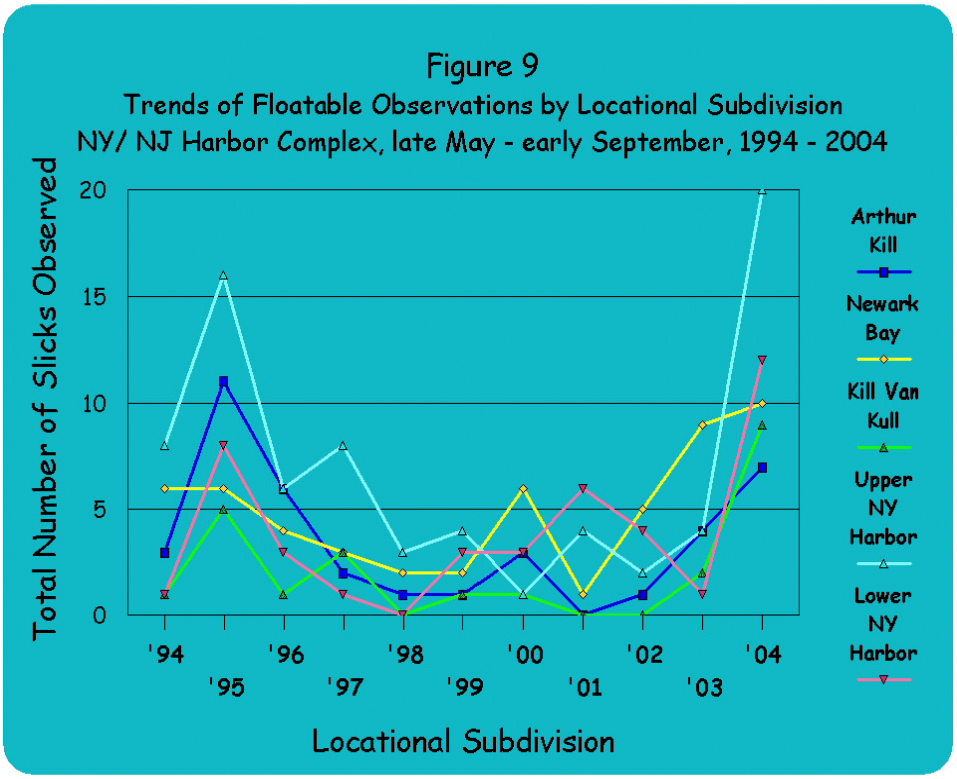
A total of 467 significant slicks was observed over a fifteen year period (Table 8). The sightings of slicks were variable from year to year with the most number of slicks, 81 reported in 1990. The least number of slick sightings, six slicks, was reported in 1998. For unknown reasons, there was a significant increase in slick sights in 2004.

FLOATABLE TRENDS

For comparison, data from the last eleven years will be presented.

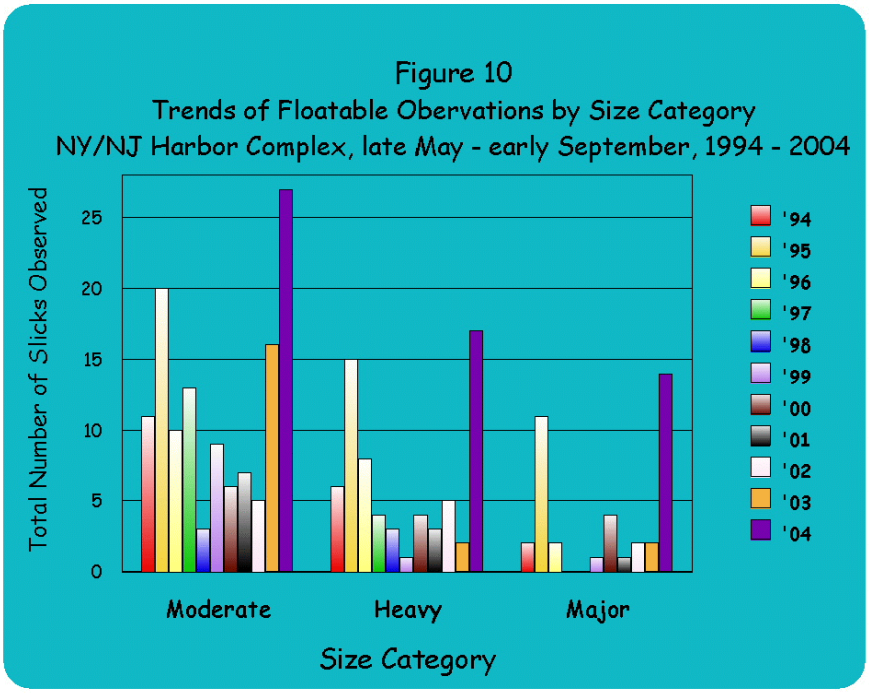
Locational Subdivision

The Upper New York Harbor had the greatest number of slicks, 76, observed in the eleven-year period. The Kill Van Kull, with 23 slicks, had the least number of slicks observed (Figure 9). During six of the eleven years, the Upper New York Harbor had the most number of slicks observed per year.



Size Category

For the eleven-year period, the majority of slicks observed, 54.3 percent, were in the moderate category, 29.1 percent were in the heavy category, and 16.7 percent were in the major category (Figure 10).



Cleanup

The inter-agency monitoring and cleanup program, the initiation of beach and litter cleanup activities, such as the Clean Streets/Clean Beaches campaign, and Operations Clean Shores have contributed to a decrease in beach closures due to floatable debris, and a significant decrease in the number of slicks observed, as compared to the extensive washups in 1987 and 1988. More information on cleanup activities can be found in the *Floatable Action Plan Assessment Report 2004* (USEPA, 2004).

Only three beach closure incidents occurred in 2003 due to floatable debis. Eleven New Jersey beaches were closed on July 11, 2003 and two New Jersey beaches were closed on August 19, 2003. All beaches were closed late in the afternoon and reopened the following morning. On July 24 and July 25, 2003, a total of five Long Island coastal beaches were closed due to flotable debris. On July 8, 2004, a seven mile long slick was reported off Sandy Hook coastline, however no beaches were closed due to this slick. There were no ocean beach closures along Long Island coastal waters or the New Jersey coastal waters due to floatable debris in 2004.

PROMOTING PARTNERSHIPS

The Helicopter Monitoring Program afforded EPA the unique opportunity to promote partnerships by assisting other federal and state agencies in the real time collection of water quality data. With a little extra coordination, EPA assisted other agencies in collecting data to complement or maintain objectives for the following national/state programs:


Skates Migrating off the New Jersey Coast

New Jersey Shellfish

During the data collection for the New Jersey beach station sampling network, additional samples were collected for phytoplankton analyses along the New Jersey coast, and in Raritan/Sandy Hook Bay, Barnegat Bay, Great Egg Harbor and Delaware Bay. Phytoplankton identification, quantification and chlorophyll *a* enumerations were completed by the New Jersey Department of Environmental Protection's (NJDEP) Aquatic Biomonitoring Laboratory of the Bureau of Water Monitoring. This sampling provides early warning of noxious algal blooms and complements NJDEP's commitment to the National Shellfish Sanitation Program.

Subsets of the phytoplankton samples collected in Barnegat Bay were provided to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service for the identification of the brown tide organism, *A. anophagefferens,* in 1999 and 2000. In 2001 through 2004, NJDEP arranged for the identification of *A. anophagefferens*.

Long Island Shellfish

During the data collection for the Long Island beach station sampling network, additional samples were collected at each station for the New York State Department of Environmental Conservation (NYSDEC). The NYSDEC's Division of Fish and Wildlife and Marine Resources Bureau of Marine Resources analyzed the samples for total and fecal coliforms. These samples help fulfill NYSDEC's commitment to the National Shellfish Sanitation Program.

New Jersey Nutrients

As part of EPA's Performance Partnership Agreement with NJDEP, surface water samples were collected three to four times each year at 41 stations from Sandy Hook to Cape May, and in Delaware Bay. The samples were analyzed by NJDEP for chlorophyll, salinity, nitrate, nitrite, ortho-phosphate, ammonia, total nitrogen, and total suspended solids. Temperature was recorded in the field and dissolved oxygen analyses were conducted by the EPA Edison Laboratory. The 41 stations are part of NJDEP's 200 Station Network.

Delaware Estuary Nutrients

At the request of the Delaware River Basin Commission (DRBC), surface water samples were collected at low slack tide at four sites along the Delaware River three times during the summer. This sampling started in 2001 and continued in 2002 and 2003. Lack of funding precluded this sampling to continue in 2004. All samples were analyzed by a contract laboratory for bacteria, algae, metals, dissolved oxygen and organic carbon. This sampling enhanced DRBC's longstanding water quality sampling program in the Delaware Estuary.

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